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(57) Abstract:
Problem to be solved: To realize excellent communication quality by allowing each recipient to select a reception rate and error immunity suitable for each reception environment and to distribute a moving picture medium in real time especially in a multicast environment in the case of simultaneous data communication by many recipients via a network.
Solution: A sender side terminal has a coder 1011 that hierarchically encodes data, an FEC data generating section 1013 that generates FEC data, a data

transmission section 1012 that transmits both the data as different data series and an FEC data transmission section 1014. A receiver side terminal has a received series selection section 1036 that selects a proper data series on the basis of a reception state, a data reception section 1031 that receives the selected data series and an FEC data reception section 1032.

[Claims]

[Claim 1] A data communication system that transmits and receives data via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers, including an encoding means that a data communication unit of the mentioned above transmitting side codes the mentioned above data hierarchical and generates coding data, a data generation means for correction that generates data for error corrections to each coding data coded hierarchical by this encoding means, a selecting means that has a transmitting means which transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series and as which a data communication unit of the mentioned above receiver chooses a suitable data series based on a receiving state from the mentioned above respectively different data

series, a reception means that receives a data series selected by this selecting means.

[Claim 2] The data communication system according to claim 1 being one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical, a fundamental series and data series that are transmitted by the mentioned above transmitting means according to a hierarchy of coding of the mentioned above data.

[Claim 3] The data communication system according to claim 2 characterized by that the mentioned above fundamental series is certainly chosen by the mentioned above selecting means from the mentioned above data series.

[Claim 4] The data communication system according to claim 1 transmitting the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively, the mentioned above data generation means for correction generates data for the mentioned above error corrections using the mentioned above data packet and the mentioned above transmitting means, a data packetized means for a data communication unit of the mentioned above transmitting side to packetize coding data coded

hierarchical by the mentioned above encoding means and to generate a data packet, a data packetized means for correction to generate a packet for error corrections using data for the mentioned above error corrections.

[Claim 5] The data communication system according to claim 4 characterized by that the mentioned above transmitting means adds data transmission time information and the series number and transmits for every data packet within the mentioned above data series.

[Claim 6] The data communication system according to claim 4 characterized by that the mentioned above data packetized means for correction generates a pay-load header including only information indispensable at the time of an error correction and generates the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections, the mentioned above data generation means for correction generates data for the mentioned above error corrections only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical.

[Claim 7] The data communication system according to claim 1 characterized by that a data communication unit of the mentioned above receiver has further a state acquisition means to acquire the mentioned above receiving state.

[Claim 8] The data communication system according to claim 7 characterized by that the mentioned above state acquisition means acquires a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state.
[Claim 9] The data communication system according to claim 8 reducing an extension series received when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold sequentially from the upper layer, an extension series that is a data series of coding data of the upper layer further when the mentioned above rate of a data loss of the mentioned above selecting means is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined

threshold, a data series for correction is received further.

[Claim 10] The data communication system according to claim 7 characterized by that the mentioned above state acquisition means acquires a rate of a data loss as the mentioned above receiving state.

[Claim 11] The data communication system according to claim 10 characterized by receiving a data series for the mentioned above error corrections further when a received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections, the mentioned above selecting means, reduce a received data series for error corrections and an extension series that is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series that is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold.

[Claim 12] The data communication system according to claim 9 or 11 characterized by that the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.
[Claim 13] The data communication system according to any one of claims 1 to 12 being able to apply to multicast communication that carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers by networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.
[Claim 14] A data communication unit including an encoding means that is a data communication unit that transmits data via a network to a data communication unit of a plurality of receivers, codes the mentioned above data hierarchical and generates coding data, a data generation means for correction that generates data for error corrections to each coding data coded hierarchical by this encoding means, a transmitting means that transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series.
[Claim 15] The data communication unit according to claim 14 being one or more extension series that are the upper layer of this fundamental series and a data series for correction according to each data for

correction generated to the mentioned above data coded hierarchical, a fundamental series and data series that are transmitted by the mentioned above transmitting means according to a hierarchy of coding of the mentioned above data.

[Claim 16] The data communication unit according to claim 15 characterized by that the mentioned above fundamental series is certainly chosen from the mentioned above data series by a data communication unit of the mentioned above receiver.

[Claim 17] The data communication unit according to claim 14 transmitting the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively, the mentioned above data generation means for correction generates data for the mentioned above error corrections using the mentioned above data packet and the mentioned above transmitting means, a data packetized means to packetize coding data coded hierarchical by the mentioned above encoding means and to generate a data packet, a data packetized means for correction to generate a packet for error corrections using data for the mentioned above error corrections.

[Claim 18] The data communication unit according to claim 17 characterized by that the mentioned above transmitting means adds data transmission time

information and the series number and transmits for every data packet within the mentioned above data series.

[Claim 19] The data communication unit according to claim 17 characterized by that the mentioned above data packetized means for correction generates a pay-load header including only information indispensable at the time of an error correction and generates the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections, the mentioned above data generation means for correction generates data for the mentioned above error corrections only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical.

[Claim 20] The data communication unit according to any one of claims 14 to 19 being able to apply to multicast communication that carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet.

[Claim 21] A data communication unit that receives data via a network from a data communication unit of the transmitting side, including a selecting means that chooses a suitable data series based on a receiving state from data series transmitted from a data communication unit of the mentioned above

transmitting side, a reception means that receives a data series selected by this selecting means.
[Claim 22] The data communication unit according to claim 21 being one or more extension series that are the upper layer of a fundamental series and this fundamental series according to a hierarchy of coding of the mentioned above data and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical, a data series transmitted from a data communication unit of the mentioned above transmitting side.
[Claim 23] The data communication unit according to claim 22 characterized by that the mentioned above fundamental series is certainly chosen by the mentioned above selecting means from the mentioned above data series.
[Claim 24] The data communication unit according to claim 21 including a state acquisition means to acquire the mentioned above receiving state.
[Claim 25] The data communication unit according to claim 24 characterized by that the mentioned above state acquisition means acquires a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state.
[Claim 26] The data communication unit according to claim 25 reducing an extension series received when the mentioned above rate of a data loss is smaller than

a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold sequentially from the upper layer, an extension series that is a data series of coding data of the upper layer further when the mentioned above rate of a data loss of the mentioned above selecting means is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, a data series for correction is received further.

[Claim 27] The data communication unit according to claim 24 characterized by that the mentioned above state acquisition means acquires a rate of a data loss as the mentioned above receiving state.

[Claim 28] The data communication unit according to claim 27 characterized by receiving a data series for the mentioned above error corrections further when a

received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections, the mentioned above selecting means, reducing a received data series for error corrections and an extension series that is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series that is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold.

[Claim 29] The data communication unit according to claim 26 or 28 characterized by that the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.

[Claim 30] The data communication unit according to any one of claims 21 to 29 being able to apply to multicast communication to which the multiple address of the data of video etc. is carried out via networks,

such as the Internet, from a data communication unit of the mentioned above transmitting side.
[Claim 31] A data communication method applied to a data communication system that transmits and receives data via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers, including a coding step which a data communication unit of the mentioned above transmitting side codes the mentioned above data hierarchical and generates coding data, a data generation step for correction that generates data for error corrections to each coding data coded hierarchical by this coding step, a selection step that has a transmission step that transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series and as which a data communication unit of the mentioned above receiver chooses a suitable data series based on a receiving state from the mentioned above respectively different data series, a receiving step that receives a data series selected by this selection step.
[Claim 32] The data communication method according to claim 31 being one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical, a fundamental series and data

series which transmits by the mentioned above transmission step according to a hierarchy of coding of the mentioned above data.

[Claim 33] The data communication method according to claim 32 characterized by that the mentioned above fundamental series is certainly chosen from the mentioned above data series in the mentioned above selection step.

[Claim 34] The data communication method according to claim 31 transmitting the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively, the mentioned above data generation step for correction, generating data for the mentioned above error corrections using the mentioned above data packet and in the mentioned above transmission step, a data packetized step that a data communication unit of the mentioned above transmitting side packetizes coding data coded hierarchical by the mentioned above coding step and generates a data packet, a data packetized step for correction that generates a packet for error corrections using data for the mentioned above error corrections.

[Claim 35] The data communication method according to claim 34 adding data transmission time information and the series number and transmitting for every data

packet within the mentioned above data series in the mentioned above transmission step.
[Claim 36] The data communication method according to claim 34 generating a pay-load header that includes only information indispensable at the time of an error correction in the mentioned above data packetized step for correction and generating the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections, in the mentioned above data generation step for correction, data for the mentioned above error corrections is generated only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical.
[Claim 37] The data communication method according to claim 31 characterized by that a data communication unit of the mentioned above receiver has further a state acquisition step that acquires the mentioned above receiving state.
[Claim 38] The data communication method according to claim 37 characterized by acquiring a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state in the mentioned above state acquisition step.
[Claim 39] The data communication method according to claim 38 reducing an extension series received when the mentioned above rate of a data loss is smaller than

a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold sequentially from the upper layer
In the mentioned above selection step, an extension series which is a data series of coding data of the upper layer further when the mentioned above rate of a data loss is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, a data series for correction is received further,.
[Claim 40] The data communication method according to claim 37 characterized by acquiring a rate of a data loss as the mentioned above receiving state in the mentioned above state acquisition step.
[Claim 41] The data communication method according to claim 40 characterized by receiving a data series for the mentioned above error corrections further when a

received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections in the mentioned above selection step, reducing a received data series for error corrections and an extension series which is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series that is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold.

[Claim 42] The data communication method according to claim 39 or 41 characterized by that the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.

[Claim 43] The data communication method according to any one of claims 31 to 42 being able to apply to multicast communication which carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via

networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.

[Claim 44] A storage that stored a program which performs a data communication method applied to a data communication system which transmits and receives data via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers in which read-out by computer is possible characterized by including a coding step that the mentioned above data communication method codes the mentioned above data hierarchical and generates coding data, a data generation step for correction which generates data for error corrections to each coding data coded hierarchical by this coding step, a transmission step controlled to transmit the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series, a selection step that chooses a suitable data series based on a receiving state from the mentioned above respectively different data series and a receiving step controlled to receive a data series selected by this selection step.

[Claim 45] The storage according to claim 44 being one or more extension series that are the upper layer of a fundamental series and this fundamental series according to a hierarchy of coding of the mentioned

above data and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical, a data series that carries out a transmission control by the mentioned above transmission step.

[Claim 46] The storage according to claim 45 characterized by that the mentioned above fundamental series is certainly chosen from the mentioned above data series in the mentioned above selection step.

[Claim 47] The storage according to claim 44 controlling to transmit the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively, the mentioned above data generation step for correction, generating data for the mentioned above error corrections using the mentioned above data packet and in the mentioned above transmission step, a data packetized step that packetizes coding data coded hierarchical by the mentioned above coding step and generates a data packet, a data packetized step for correction that generates a packet for error corrections using data for the mentioned above error corrections.

[Claim 48] The storage according to claim 47 controlling by the mentioned above transmission step to add data transmission time information and the

series number and to transmit for every data packet within the mentioned above data series.
[Claim 49] The storage according to claim 47 generating a pay-load header that includes only information indispensable at the time of an error correction in the mentioned above data packetized step for correction and generating the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections, in the mentioned above data generation step for correction, data for the mentioned above error corrections is generated only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical.
[Claim 50] The storage according to claim 44 including a state acquisition step that acquires the mentioned above receiving state.
[Claim 51] The storage according to claim 50 characterized by acquiring a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state in the mentioned above state acquisition step.
[Claim 52] The storage according to claim 51 reducing an extension series received when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception

rate than a predetermined threshold sequentially from the upper layer, it controls by the mentioned above selection step to receive an extension series which is a data series of coding data of the upper layer further, when the mentioned above rate of a data loss is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, it controls to receive a data series for correction further, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold.

[Claim 53] The storage according to claim 50 characterized by acquiring a rate of a data loss as the mentioned above receiving state in the mentioned above state acquisition step.

[Claim 54] The storage according to claim 53 controlling to receive a data series for the mentioned above error corrections further, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the

mentioned above error corrections in the mentioned above selection step, it controls to reduce a received data series for error corrections and to receive an extension series that is a data series of coding data of the upper layer further, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when it controls to receive an extension series which is a data series of coding data of the upper layer and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold, when it controls to reduce a received extension series and to receive a data series for the mentioned above error corrections further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold.

[Claim 55] The storage according to claim 52 or 54 characterized by that the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.

[Claim 56] The storage according to any one of claims 44 - 55 being able to apply to multicast communication that carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.

[Detailed description of the invention]

[0001]

[Field of the invention] This invention about a data communication system, a data communication unit, a data communication method and a storage in more details, data by which it is generated regularly, such as an image and a sound, is related with a suitable data communication system, a data communication unit, a data communication method and a storage, when performing real time transmission/reception through a network.

[0002]

[Description of the prior art] Generally, when performing data communications in quality the network of not guaranteeing like the Internet, the data loss by the error produced in the network is not avoided. When transmitting the video especially compressed by difference codecs, such as H.263 (international standards of a full color video coding mode) and MPEG (Moving Picture Experts Group: full color video compression technology), the influence of a data loss, the space of a picture, in order to spread also to a time direction, the correspondence to an error has been an important technical problem as a problem different from control of a transmission rate.

[0003] As a means for restoring this data loss, the technique of Forward Error Correction (FEC: automatic error correction method) is considered.

This transmits preliminary the data (FEC data) for performing an error correction redundantly and when an error actually occurs in a network, it restores the data lost using this FEC data. It is thought that it is suitable for communication of especially real time video in that the time delay that error restoration takes compared with the method which performs resending of loss data, etc. can be suppressed comparatively low. As directions of FEC, IETF (Internet Engineering Task Force: International Engineering Task Force), Internet Draft (RTP Payload Format for Generic Forward Error Correction) is proposed.

[0004] In this case, how many data volume of FEC are added changes with network situations. Then, the technique of adjusting the redundant data volume for FEC is devised by the network situation. Even if many terminals exist, such art is made on the assumption not to transmit / which carried out data of kinds. However, under the situation where many receiving terminals exist, to adjust the amount of error correction data the optimal for every receiving terminal is desired.

[0005]

[Problems to be solved by the invention] On the other hand, when transmitting continuous media called a video audio to a plurality of receiving terminals simultaneously by a network in real time, the quality of the media that is transmitted poses a problem.

When especially the network environments of each receiving terminal differ, the problem whether quality media should be transmitted according to the terminal connected in the network of the broadband or quality should be adjusted to a terminal without the capability that only the media of low quality can receive arises. Then, it hierarchically encodes, media data is compressed and the technique of transmitting each hierarchy by another stream is proposed. Even if only a basic hierarchy receives, the data of minimum quality can be received and quality media can be gradually received now by being added more to the data stream (data series) of the upper layer one by one and receiving.

[0006] Thus, the receiving terminal with a narrow effective band during transmission and reception, only the stream of a basic low order layer is received, minimum quality is acquired, the receiving terminal with the network of a broadband is received to the stream of the upper layer that can reproduce quality media and the way quality media are obtained is devised. In such a technique, quality can transmit variously different data to a plurality of receiving terminals accommodative. In order to correspond to the network with which the reliability of a transmission line differs, it is desirable to also adjust the addition amount of error correction data according to the network state for every receiving terminal.

[0007] By the way, the network (Ethernet (LAN of the bus structure that 3 companies of U.S. Xerox, DEC, Intel developed jointly)) of a different communication method like the Internet, in the network with which ISDN (Integrated Service Digital Network: Comprehensive Digital Network), a modem, etc. are intermingled on the way and various data flows into an intermediate node, a multiple address system like multicasting (method that transmits the same data to a plurality of terminals by one packet) is spreading. In such a situation, when transmitting continuous media called a video audio to real time simultaneous to many receiving terminals, according to the topology of the network for every receiving terminal, the quantity of external traffic, etc., it is necessary to realize the data transmission method in consideration of the optimal quality and the optimal error tolerance.

[0008] As mentioned above, the multicast communication that carries out the multiple address of the media data of video etc. to many addressees by a network is beginning to spread, but when performing such communication, the correspondence to greatly different communication environment among addressees poses a problem. Namely, if it transmits at a high rate according to the addressee who has connected with sufficient bandwidth, if superfluous data flows into an addressee's channel connected in the narrow bandwidth, congestion arises and transmission

with a low rate is conversely performed according to a low speed line, it will be a problem of the addressee of a broadband using bandwidth and stopping going out. In order to cope with this problem, at the transmitting side, a plurality of hierarchically encoded send data series (data stream) is transmitted and the method of choosing only a suitable series and receiving out of these data series, by the addressee side, is proposed. The addressee who the addressee who can use a broadband receives the series of a high rate or a large number by this and is connected by a narrow-band line can realize communication with a reception rate with each respectively suitable addressee by receiving only the series of a low rate or a small number.

[0009] By the way, when the communication environment between addressees differs greatly like multicasting, also, the generation states of an error differ for every addressee, thus it is necessary for an addressee to be able to choose not only a reception rate but the grade of error tolerance guaranteed according to communication environment in order to realize good communication quality.

[0010] This invention is made in view of the point mentioned above, when performing data communications simultaneously with many addressees by the purpose and each addressee chooses a reception rate and error tolerance suitable for each receiving environment, it is providing the data communication

system, the data communication unit, data communication method and storage that realized good communication quality and enabled distribution of real time animation media especially in multicasting environment.

[0011]

[Means for solving the problem] To achieve the above objects, data communication system of this invention that transmits and receives data via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers is characterized by that the invention according to claim 1 includes an encoding means which a data communication unit of the mentioned above transmitting side codes the mentioned above data hierarchical and generates coding data, a data generation means for correction which generates data for error corrections to each coding data coded hierarchical by this encoding means, a selecting means that has a transmitting means which transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series and as which a data communication unit of the mentioned above receiver chooses a suitable data series based on a receiving state from the mentioned above respectively different data series, a reception means that receives a data series selected by this selecting means.

[0012] To achieve the above objects, the invention according to claim 2, a data series that are transmitted by the mentioned above transmitting means is characterized by being a fundamental series according to a hierarchy of coding of the mentioned above data, one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical.

[0013] To achieve the above objects, as for the invention according to claim 3, the mentioned above fundamental series is certainly chosen by the mentioned above selecting means from the mentioned above data series.

[0014] To achieve the above objects, the invention according to claim 4, a data packetized means for a data communication unit of the mentioned above transmitting side to packetize coding data coded hierarchical by the mentioned above encoding means and to generate a data packet, including a data packetized means for correction to generate a packet for error corrections using data for the mentioned above error corrections and the mentioned above data generation means for correction, generating data for the mentioned above error corrections using the mentioned above data packet, the mentioned above transmitting means transmits the mentioned above data

packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively.

[0015] To achieve the above objects, for every data packet within the mentioned above data series, the mentioned above transmitting means adds data transmission time information and the series number and the invention according to claim 5 transmits it.

[0016] To achieve the above objects, the invention according to claim 6, the mentioned above data generation means for correction generates data for the mentioned above error corrections only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical, the mentioned above data packetized means for correction generates a pay-load header including only information indispensable at the time of an error correction and generates the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections.

[0017] To achieve the above objects, the invention according to claim 7 has a state acquisition means by which a data communication unit of the mentioned above receiver acquires the mentioned above receiving state further.

[0018] To achieve the above objects, in the invention according to claim 8, the mentioned above state acquisition means acquires a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state.

[0019] To achieve the above objects, the invention according to claim 9, an extension series that is a data series of coding data of the upper layer further when the mentioned above rate of a data loss of the mentioned above selecting means is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, a data series for correction is received further, when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined

threshold, an extension series to receive is reduced sequentially from the upper layer.

[0020] To achieve the above objects, in the invention according to claim 10, the mentioned above state acquisition means acquires a rate of a data loss as the mentioned above receiving state.

[0021] To achieve the above objects, the invention according to claim 11, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections, the mentioned above selecting means, reduce a received data series for error corrections and an extension series which is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series which is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold, when a received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, a data series for the mentioned above error corrections is received further.

[0022] To achieve the above objects, as for the invention according to claim 12, the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.
[0023] To achieve the above objects, the invention according to claim 13 is characterized by the ability to apply to multicast communication that carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.
[0024] To achieve the above objects, the invention according to claim 14, an encoding means which is a data communication unit that transmits data via a network to a data communication unit of a plurality of receivers, codes the mentioned above data hierarchical and generates coding data, a data generation means for correction which generates data for error corrections to each coding data coded hierarchical by this encoding means, it includes a transmitting means that transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively different data series.
[0025] To achieve the above objects, the invention according to claim 15, a data series that are transmitted by the mentioned above transmitting means is characterized by being a fundamental series according

to a hierarchy of coding of the mentioned above data, one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical.

[0026] To achieve the above objects, as for the invention according to claim 16, the mentioned above fundamental series is certainly chosen from the mentioned above data series by a data communication unit of the mentioned above receiver.

[0027] To achieve the above objects, the invention according to claim 17, a data packetized means to packetize coding data coded hierarchical by the mentioned above encoding means and to generate a data packet, including a data packetized means for correction to generate a packet for error corrections using data for the mentioned above error corrections and the mentioned above data generation means for correction, generating data for the mentioned above error corrections using the mentioned above data packet, the mentioned above transmitting means transmits the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively.

[0028] To achieve the above objects, for every data packet within the mentioned above data series, the mentioned above transmitting means adds data transmission time information and the series number and the invention according to claim 18 transmits it.
[0029] To achieve the above objects, the invention according to claim 19, the mentioned above data generation means for correction generates data for the mentioned above error corrections only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical, the mentioned above data packetized means for correction generates a pay-load header including only information indispensable at the time of an error correction and generates the mentioned above packet for error corrections using data and the mentioned above pay-load header for the mentioned above error corrections.
[0030] To achieve the above objects, the invention according to claim 20 is characterized by the ability to apply to multicast communication which carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet.
[0031] To achieve the above objects, the invention according to claim 21 is characterized by that a data communication unit that receives data via a network from a data communication unit of the transmitting

side includes the a selecting means that chooses a suitable data series based on a receiving state from data series transmitted from a data communication unit of the mentioned above transmitting side, a reception means that receives a data series selected by this selecting means.

[0032] To achieve the above objects, the invention according to claim 22, a data series transmitted from a data communication unit of the mentioned above transmitting side, it is characterized by being one or more extension series that are the upper layer of a fundamental series and this fundamental series according to a hierarchy of coding of the mentioned above data and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical.

[0033] To achieve the above objects, as for the invention according to claim 23, the mentioned above fundamental series is certainly chosen by the mentioned above selecting means from the mentioned above data series.

[0034] To achieve the above objects, the invention according to claim 24 has further a state acquisition means to acquire the mentioned above receiving state.

[0035] To achieve the above objects, in the invention according to claim 25, the mentioned above state acquisition means acquires a rate of a data loss, a

transmission rate and a reception rate as the mentioned above receiving state.

[0036] To achieve the above objects, the invention according to claim 26, an extension series that is a data series of coding data of the upper layer further when the mentioned above rate of a data loss of the mentioned above selecting means is larger than a threshold predetermined in a ratio of the mentioned above transmis sion rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, a data series for correction is received further, when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, an extension series to receive is reduced sequentially from the upper layer.

[0037] To achieve the above objects, in the invention according to claim 27, the mentioned above state acquisition means acquires a rate of a data loss as the mentioned above receiving state.
[0038] To achieve the above objects, the invention according to claim 28, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections, the mentioned above selecting means, reducing a received data series for error corrections and an extension series that is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series that is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold, when a received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, a data series for the mentioned above error corrections is received further.

[0039] To achieve the above objects, as for the invention according to claim 29, the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.
[0040] To achieve the above objects, the invention according to claim 30 is characterized by the ability to apply to multicast communication to which the multiple address of the data of video etc. is carried out via networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.
[0041] To achieve the above objects, data communication method of this invention applied to a data communication system for which data is transmitted and received via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers is characterized by that the invention according to claim 31 includes a coding step in which a data communication unit of the mentioned above transmitting side codes the mentioned above data hierarchical and generates coding data, a data generation step for correction that generates data for error corrections to each coding data coded hierarchical by this coding step, a selection step that has a transmission step which transmits the mentioned above coding data coded hierarchical and data for the mentioned above error corrections as a respectively

different data series and as which a data communication unit of the mentioned above receiver chooses a suitable data series based on a receiving state from the mentioned above respectively different data series, a receiving step that receives a data series selected by this selection step.

[0042] To achieve the above objects, the invention according to claim 32, a data series which transmits by the mentioned above transmission step is characterized by being a fundamental series according to a hierarchy of coding of the mentioned above data, one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical.

[0043] To achieve the above objects, as for the invention according to claim 33, the mentioned above fundamental series is certainly chosen from the mentioned above data series in the mentioned above selection step. To achieve the above objects, the invention according to claim 34, a data packetized step that a data communication unit of the mentioned above transmitting side packetizes coding data coded hierarchical by the mentioned above coding step and generates a data packet, including a data packetized step for correction that generates a packet for error corrections using data for the mentioned above error corrections and in the mentioned above data generation

step for correction. Data for the mentioned above error corrections is generated using the mentioned above data packet and the mentioned above data packet and the mentioned above packet for error corrections are transmitted in the mentioned above transmission step as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively.

[0044] To achieve the above objects, in the mentioned above transmission step, for every data packet within the mentioned above data series, the invention according to claim 35 adds data transmission time information and the series number and transmits.

[0045] To achieve the above objects, the invention according to claim 36, in the mentioned above data generation step for correction, data for the mentioned above error corrections is generated only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical, in the mentioned above data packetized step for correction, a pay-load header including only information indispensable at the time of an error correction is generated and the mentioned above packet for error corrections is generated using data and the mentioned above pay-load header for the mentioned above error corrections.

[0046] To achieve the above objects, the invention according to claim 37 has a state acquisition step from which a data communication unit of the mentioned above receiver acquires the mentioned above receiving state further.
[0047] To achieve the above objects, the invention according to claim 38 acquires a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state in the mentioned above state acquisition step.
[0048] To achieve the above objects, the invention according to claim 39, in the mentioned above selection step, an extension series that is a data series of coding data of the upper layer further when the mentioned above rate of a data loss is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is received, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, a data series for correction is received

further, when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, an extension series to receive is reduced sequentially from the upper layer.

[0049] To achieve the above objects, the invention according to claim 40 acquires a rate of a data loss as the mentioned above receiving state in the mentioned above state acquisition step.

[0050] To achieve the above objects, the invention according to claim 41, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections in the mentioned above selection step, reducing a received data series for error corrections and an extension series that is a data series of coding data of the upper layer further is received, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when an extension series that is a data series of coding data of the upper layer is received and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold, when a received extension series is reduced, a data series for the mentioned above error corrections is received further and the mentioned above rate of a data loss has

not received an extension series more greatly than a predetermined threshold, a data series for the mentioned above error corrections is received further.
[0051] To achieve the above objects, as for the invention according to claim 42, the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.
[0052] To achieve the above objects, the invention according to claim 43 is characterized by the ability to apply to multicast communication that carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.
[0053] To achieve the above objects, this invention the invention according to claim 44, by computer that stored a program which performs a data communication method applied to a data communication system which transmits and receives data via a network between a data communication unit of the transmitting side and a data communication unit of a plurality of receivers. A storage that can be read is characterized by including a coding step that the mentioned above data communication method codes the mentioned above data hierarchical and generates coding data, a data generation step for correction that generates data for error corrections to each coding data

coded h ierarchical by this coding step, a transmission step controlled to transmit the mentioned above coding data coded hierarchic al and data for the mentioned above error corrections as a respectively different data series, a selection step that chooses a suitable data series based on a receiving state from the mentioned above respectively different data series and a receiving step controlled to receive a data series selected by this selection step.

[0054] To achieve the above objects, the invention according to claim 45, a data series that carries out a transmission control by the mentioned above transmission step is characterized by being a fundamental series according to a hierarchy of coding of the mentioned above data, one or more extension series which are the upper layer of this fundamental series and a data series for correction according to each data for correction generated to the mentioned above data coded hierarchical.

[0055] To achieve the above objects, as for the invention according to claim 46, the mentioned above fundamental series is certainly chosen from the mentioned above data series in the mentioned above selection step.

[0056] To achieve the above objects, the invention according to claim 47, a data packetized step that packetizes coding data coded hierarchical by the mentioned above coding step and generates a data

packet, including a data packetized step for correction that generates a packet for error corrections using data for the mentioned above error corrections and in the mentioned above data generation step for correction. Generating data for the mentioned above error corrections using the mentioned above data packet and in the mentioned above transmission step. It controls to transmit the mentioned above data packet and the mentioned above packet for error corrections as a data series of the mentioned above coding data and a data series of data for the mentioned above error corrections, respectively.

[0057] To achieve the above objects, the invention according to claim 48 is controlled by the mentioned above transmission step to add data transmission time information and the series number and to transmit for every data packet within the mentioned above data series.

[0058] To achieve the above objects, the invention according to claim 49, in the mentioned above data generation step for correction, data for the mentioned above error corrections is generated only using a coding data portion of this data packet with reference to a data packet of the mentioned above data coded hierarchical, in the mentioned above data packetized step for correction, a pay-load header including only information indispensable at the time of an error correction is generated and the mentioned above

packet for error corrections is generated using data and the mentioned above pay-load header for the mentioned above error corrections.

[0059] To achieve the above objects, the invention according to claim 50 has further a state acquisition step that acquires the mentioned above receiving state.

[0060] To achieve the above objects, the invention according to claim 51 acquires a rate of a data loss, a transmission rate and a reception rate as the mentioned above receiving state in the mentioned above state acquisition step.

[0061] To achieve the above objects, the invention according to claim 52, it controls by the mentioned above selection step to receive an extension series that is a data series of coding data of the upper layer further, when the mentioned above rate of a data loss is larger than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold, a data series for correction received when the mentioned above rate of a data loss is smaller than a threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate smaller than a predetermined threshold is reduced, it controls to receive a data series for correction further, when the mentioned above rate of a data loss is larger than a larger threshold predetermined in a ratio of the mentioned above

transmission rate and the mentioned above reception rate than a predetermined threshold, when the mentioned above rate of a data loss is smaller than a larger threshold predetermined in a ratio of the mentioned above transmission rate and the mentioned above reception rate than a predetermined threshold, an extension series to receive is reduced sequentially from the upper layer.

[0062] To achieve the above objects, the invention according to claim 53 acquires a rate of a data loss as the mentioned above receiving state in the mentioned above state acquisition step.

[0063] To achieve the above objects, the invention according to claim 54, when the mentioned above rate of a data loss is receiving a data series smaller than a predetermined threshold for the mentioned above error corrections in the mentioned above selection step, it controls to reduce a received data series for error corrections and to receive an extension series that is a data series of coding data of the upper layer further, when the mentioned above rate of a data loss has not received a data series smaller than a predetermined threshold for the mentioned above error corrections, when it controls to receive an extension series that is a data series of coding data of the upper layer and the mentioned above rate of a data loss is receiving an extension series more greatly than a predetermined threshold, when it controls to reduce a received

extension series and to receive a data series for the mentioned above error corrections further and the mentioned above rate of a data loss has not received an extension series more greatly than a predetermined threshold, it controls to receive a data series for the mentioned above error corrections further.
[0064] To achieve the above objects, as for the invention according to claim 55, the mentioned above predetermined threshold is determined according to a coding mode of the mentioned above coding data.
[0065] To achieve the above objects, the invention according to claim 56 is characterized by the ability to apply to multicast communication which carries out the multiple address of the data of video etc. to a data communication unit of a plurality of receivers via networks, such as the Internet, from a data communication unit of the mentioned above transmitting side.
[0066]
[Embodiment of the invention] Next, the 1st embodiment and 2nd embodiment of this invention are described in details based on a drawing.
[0067] [The 1st embodiment] Drawing 1 is a block diagram showing the composition of the data communication unit according to the 1st embodiment of this invention. Via the network 1-3, as for the data communication unit according to the 1st embodiment of this invention, the transmission terminal 1-1 and a

plurality of receiving terminals 1-21, 1-22... are constituted so that communication is possible. Drawing 1 shows the internal configuration and connecting relation of each terminal in the case of receiving the data which the transmission terminal 1-1 transmits by the receiving terminal 1-21, 1-22... via the network 1-3.

[0068] The mentioned above transmission terminal 1-1, the data generating section 1-11, the layer 1 transmission section (BaseLayer1) 1-121, the layer 2 transmission section (FECLayer1) 1-122, the layer 3 transmission section (Enhancement Layer 2) 1-123, layer 4 transmission section (FEC), it has Layer 21-124 and the layer 5 transmission section (Enhancement Layer 3) 1-125. The mentioned above receiving terminal 1-21 is provided with the data reception section 1-211, the data processing section 1-212, the receiving layer selecting section 1-213 and the receiving condition monitor section 1-124. Other receiving terminal omits a graphic display like the mentioned above receiving terminal 1-21, 1-22... for composition.

[0069] In the network 1-3 in the 1st embodiment of this invention here. It includes to a large-scale thing that many and unspecified networks like what is called the Internet combined from LAN (Local Area Network) currently managed by the in-house and does not specify about the embodiment.

[0070] If the mentioned above composition is explained in full details with operation, the picture image data etc. by which the capture was specifically carried out with the video camera as data which the transmission terminal 1-1 transmits can be considered, but as contents of data, it does not restrict to an image. In the transmission terminal 1-1, the data generating section 1-11 codes the media that transmit hierarchical. Since hierarchical encoding is used, when it reappears only by a Base layer (fundamental series), it is of inferior quality, but media are reproducible at worst. The Enhancement layer (extension series) of a higher rank is combining with a Base layer and using and can reproduce media in high quality more. For example, resolution serves as a high, high picture of the frame rate in case of the case of an image. The data by which hierarchical encoding was carried out is packetized for transmission and the FEC data for an error correction is generated about each hierarchy based on the packetized data. A parity packet etc. shall be used as FEC data.

[0071] A Base layer, each Enhancement layer and the error correction layer to each are sent to another layer transmission section (data transmission section) 1-121 to 1-125 as a respectively different stream. The layer transmission section (data transmission section) 1-121 to 1-125, the information on the time which transmits a series number and data for every packet is added, each

layer is sent out to the network 1-3 as another stream and multicasting (distribute the same information to a plurality of specific addresses) is carried out to it. It shall be chosen by the receiving terminal 1-21, 1-22... which layer is received.

[0072] On the other hand, each receiving terminal 1-21, 1-22... receives only a suitable thing among each layer transmitted. The received data is sent to the data processing section 1-212 and is processed. For example, when data is an image, processings (decryption, display processing, etc.) for displaying an image are performed by the data processing section 1-212. In each receiving terminal 1-21, 1-22..., during data receiving, the receiving condition monitor section 1-214 monitors receiving conditions, such as packet loss and a transit delay and sends the information to the receiving layer selecting section 1-213. The receiving layer selecting section 1-213 determines the layer that should receive according to the sent receiving condition. It reports that the receiving layer selecting section 1-213 receives about the determined layer to the data reception section 1-211 and the data reception section 1-211 continues receiving the specified layer.

[0073] Next, the transmission terminal 1-1 of the data communication unit according to the 1st embodiment of this invention constituted like the above and each receiving terminal 1-21, 1-22..., it explains referring to

drawing 2 - drawing 4 for operation. Drawing 2 is the flow chart which shows the data transmission processing by the side of the transmission terminal of the data communication unit for the 1st embodiment of this invention, drawing 3 is the flow chart which shows the data receiving processing by the side of the receiving terminal of the data communication unit for the 1st embodiment of this invention and drawing 4 is flow chart which shows the receiving terminal 1-21, 1-22… of the data communication unit and the receiving layer selection process according to the 1st embodiment of this invention.

[0074] First, operation of the transmission terminal 1-1 of a data communication unit is explained based on the flow chart of drawing 2.

[0075] First, in the transmission terminal 1-1, the data that should be transmitted is incorporated (Step S201) and hierarchical encoding of the data is carried out (Step S202). By hierarchical encoding art, most, based on a low-ranking Base layer, it shall compress by adding an Enhancement layer one by one from a low rank, so that quality improves gradually. Each hierarchy data is packetized and the stream of a Base layer and the stream of each Enhancement layer are generated (Step S203). For example, when it codes to three hierarchies, as for the stream of a Base layer, two layer generation of the stream of one layer and an Enhancement layer will be carried out.

[0076] And with reference to a data packet, the packet for an error correction is generated about each hierarchy data and one stream of data streams of a FEC layer are generated at a time about each hierarchy (Step S204). A parity packet etc. may be used for an error correction. Thus, with the media data and FEC data which were hierarchically encoded, the layer of a data stream is generated and it is sent out on the network 1-3 as a respectively different data stream (Step S205). When data is sent out to the network 1-3 (Step S205), the series number managed the whole stream and the information on the time stamp of transmission time are given to a packet.
[0077] Next, each receiving terminal 1-21, 1-22... of the data communication unit according to the 1st embodiment of this invention, operation is explained based on the flow chart of drawing 3.
[0078] At each receiving terminal 1-21, 1-22..., the data transmitted by the network 1-3 from the transmission terminal 1-1 is received by the data reception section 1-211 (Step S301). The data sent from the transmission terminal 1-1 is processed by the data processing section 1-212 (Step S302). The display of an image is performed when picture image data has been sent from the transmission terminal 1-1.
[0079] Each receiving terminal 1-21, 1-22... is one side and monitor the statistical information of a transmitting and receiving condition periodically (Step S303).

As a transmitting and receiving condition at this time, a packet loss rate, a transmission rate, a reception rate, etc. are mentioned. A packet loss rate is measurable from the number of things missing among the series numbers given to send data. A transmission rate can be guessed from the time stamp and series number that were given to send data. A reception rate is easily calculable by the packet size of received data and the log of time. And the layer of the data that the receiving terminal should receive is chosen from the transmitting and receiving condition (Step S304). When there is change to a receiving layer by selection, the layer which actually receives is changed (Step S305) and reception of data is continued after change about the data of the layer which will receive.

[0080] Next, the receiving terminal 1-21, 1-22... of the data communication unit according to the 1st embodiment of this invention and the receiving layer selection process are explained based on the flow chart of drawing 4.

[0081] First, a packet loss rate is investigated and the ratio of a reception rate to a transmission rate is compared with a threshold (for example, 0.9) below as compared with a threshold (for example, 5%) (Step S401) (Step S402). When a loss rate is smaller than a threshold and a transceiver rate ratio is larger than a threshold, since there are also few losses, the Enhancement layer of the upper layer shall be received

by a zone having a margin (Step S403). When a loss rate is smaller than a threshold and a transceiver rate ratio is also smaller than a threshold, it seems that there are few losses and the quality of a channel is good, but what transmitted cannot fully be received but it seems that there is only no bandwidth that fully receives the data volume transmitted. In this case, since it is not necessary to receive a redundant FEC layer vainly, the FEC layer that has received is reduced (Step S404).

[0082] Since it is thought that there is no reliability in a channel, it is newly begun for the bandwidth of the network 1-3 to be enough, when a loss rate is larger than a threshold and a transceiver rate ratio is larger than a threshold enough, but to receive a FEC layer (Step S406). On the other hand, since it seems that bandwidth is fundamentally insufficient when a loss rate is larger than a threshold and a transceiver rate ratio is smaller than a threshold, the Enhancement layer that receives is reduced sequentially from the thing of a higher rank (Step S407). Under the present circumstances, when the FEC layer about the Enhancement layer that cancels that reception has also received, reception of this FEC layer is stopped too.

[0083] Repeating the above steps, the transmission terminal 1-1 sends out the data stream of a plurality of generated layers on the network 1-3 by FEC for the data and the error correction by which hierarchical encoding was carried out.

In the receiving terminal 1-21, 1-22..., according to a receiving condition, the data of a layer suitable as mentioned above is chosen and it receives.

[0084] Drawing 5 is an explanatory view showing the transmitting and receiving condition of the hierarchically encoded data realizable with the mentioned above technique according to the 1st embodiment of this invention. Among a drawing, the upper section is the transmitting side and is an example of the hierarchical data currently prepared by hierarchical encoding and the error correction. A Base layer and two Enhancement layers are generated in this example. The FEC layer for every one-layer error correction of three layers is prepared for a total of three data streams, respectively. Only a Base stream will receive the narrow receiving terminal (client) of a network band like in a drawing A.

[0085] Although the receiving terminal with a network band large on the other hand to some extent (client) will receive three data streams like in a drawing B or C, for example, the receiving terminal connected by the unstable network with much packet loss receives a FEC stream like in a drawing B. The receiving terminal connected in the network which, on the other hand, has reliability with little packet loss will not receive a FEC stream like in a drawing C, but will receive a media data stream to a quality top layer.

[0086] Drawing 6 is a block diagram showing the example which applied the data communication unit according to the 1st embodiment of this invention mentioned above to the data communication system. Profile composition of the data communication system according to the 1st embodiment of this invention is carried out from the camera server 10 and the client 20. The camera server 10 is provided with the camera 100, the capturing section 101, the interface 102, CPU103, ROM104, RAM105, the external storage 106, the keyboard 107, the display 108 and the communication interface 109. The client 20 is provided with CPU203, ROM204, RAM205, the external storage 206, the keyboard 207, the display 208 and the communication interface 209. 300 in a drawing shows a network.
[0087] If the mentioned above composition is explained in full details, the camera server 10 will transmit the picture image data captured with the camera 100 to the client 20 by the network 300. In correspondence with the composition of drawing 6 and the composition of the mentioned above drawing 1, the camera server 10 corresponds to the transmission terminal 1-1 and dealing with the receiving terminal 1-21 can understand the client 20. A plurality of these clients 20 will exist in a different place connected in the network 300.

[0088] Now, the hardware difference between the camera server 10 and the client 20 is a difference in whether it has the camera and the capturing section and the camera server 10 and client 20 both sides can realize it with a personal computer. That is, the numerals 103-109 and the numerals 203-209 are the same composition substantially and each can realize them by general-purpose computer (for example, personal computer).

[0089] On the other hand, by software in the camera server 10, software for compressing the picture image data which carried out the capture, generating the data of an error correction and transmitting to the client 20 (it is stored in the external storage 106) it performs by being loaded to RAM105, it is operating and differs at the client 20 in that the software (it is stored in the external storage 206 and it is loaded to RAM205 and performs) that receives picture image data and displays it operates. About compression of data, although it is also possible to carry out in hardware by a capture card and to carry out by software, it becomes conditions for that it is compressible using hierarchical encoding art to realize the 1st embodiment of this invention.

[0090] However, in this example, when it divides into the camera server 10 and the client 20 for convenience and is only shown and a video capture function is added to both sides, both sides can function as a camera server and a client.

[0091] Now, it explains, referring to the flow chart of drawing 7 - drawing 9 for the operation in the case of applying operation of the data communication unit of the mentioned above drawing 1 explained previously to the data communication system of drawing 6. Drawing 7 is the flow chart which shows the transmitting processing in the camera server for the 1st embodiment of this invention, drawing 8 is the flow chart which shows the data receiving processing in the client for the 1st embodiment of this invention and drawing 9 is flow charts which show the receiving layer change processing in the client according to the 1st embodiment of this invention.

[0092] First, it explains from operation of the camera server 10 (drawing 7). First, in the camera server 10, the image which carried out the capture from the camera 100 by the capturing section 101 according to the capture interval is incorporated (Step S701). Hierarchical encoding of the image by which the capture was carried out by the capturing section 101 is carried out to a plurality of hierarchies (Step S702). Next, it is divided into the packet of a suitable size for every hierarchy (Step S703). The parity packet for an error correction is generated about the media data of each packetized layer (Step S704). A parity packet shall be added to one number packet of media data.

[0093] Thus, rate adjustment is carried out so that it may be enough for the following capture timing and the data of each generated layer is transmitted on the network 300 as a respectively different data stream (Step S705). The camera server 10 repeats from the capture of an image to transmission periodically as mentioned above.

[0094] On the other hand, although it is processing of the client 20, data receiving processing (drawing 8) is explained first. First, in the client 20, the data of the receiving layer that arrived from the camera server 10 is received (Step S801). When packet loss is investigated and there is a loss in the stage which data of one frame reached, an error correction packet recovers (Step S802). Next, the data after an error correction is decoded, an image is generated (Step S803) and it displays on the display 208 (Step S804).

[0095] Next, the receiving layer change processing (drawing 9) in the client 20 is explained. First, in the client 20, an initial receiving layer is decided at the time of starting (Step S811) and an initial layer change timer is set up (Step S812). Next, when it confirms whether the time of the initial layer change timer has run out (Step S813) and the time of the initial layer change timer has passed, the statistical information of a receiving condition is checked (Step S814). Next, in accordance with the mentioned above technique (drawing 4), a receiving layer is determined and

changed from the receiving condition (Step S815). Change of this receiving layer has influence as change of the specification receiving layer of the mentioned above reception. Next, a receiving layer change timer is set up again (Step S816), it returns to the mentioned above step S813 and processing of the mentioned above step S813 to the step S816 is repeated.

[0096] The above result the simultaneous data transfer to a plurality of receiving terminals through a network, when hierarchical encoding and an error correction generate a plurality of streams by the transmitting terminal side and a receiving terminal chooses the optimal receiving data stream according to the situation of the network for every receiving terminal, the optimal data transfer can carry out.

[0097] When the Internet is assumed as a target network by the mentioned above embodiment, as a method of sending out the data to a network, IP (Internet Protocol) multicasting standardized from IETF (Internet Engineering Task Force) can be used. In this case, a receiving terminal as a method of choosing the stream which receives from a plurality of layers, join to a multicast group and the message of leave which use IGMP (Internet Group Membership Protocol) can be used.

[0098] Although it is a data rate of the Base layer of the mentioned above embodiment and an Enhancement layer, to enable it to set this up suitably according to

the kind of interface linked to a network kind and its network is desired. For example, if the mentioned above system is built in the company, since it will be Ethernet (Ethernet: LAN, access speed: 10Mbps and 100Mbps of a bus structure which three companies of U.S. Xerox, DEC, Intel developed jointly), it will be able to be set as the high transfer rate.

[0099] As explained above, according to the data communication unit according to the 1st embodiment of this invention. Transmit the data generating section 1-11 that codes the data of transmission object media hierarchical and hierarchical encoding data as a respectively different data stream and. The transmission terminal 1-1 provided with the layer transmission section 1-121 to 1-125 that generates the data for error corrections to each data stream and transmits as another stream respectively, since it has the receiving terminal 1-21 provided with the receiving condition monitor section 1-214 which monitors a receiving condition, the receiving layer selecting section 1-213 that chooses a suitable data stream based on a receiving condition and the data reception section 1-211 which receives the selected data stream, following operations and effects are done so.

[0100] In the mentioned above composition, by the transmission terminal 1-1, the hierarchical encoding of transmission object data, packetizing of each hierarchy's data, generation of the stream of a base

layer and the stream of each enhancement layer, it generates data of each hierarchy generation of the packet for an error correction and one stream of data streams of a FEC layer at a time about each hierarchy, hierarchically encoding media data and FEC data generate the layer of a data stream and it sends out to the network 1-3 as another data stream respectively. The series number managed the whole stream and the information on the time stamp of transmission time are given to a packet.

[0101] In the receiving terminal 1-21, 1-22…, the receiving layer based on the monitor of the statistical information of a transmitting and receiving condition, selection of the layer of data that should receive based on a transmitting and receiving condition and receiving layer selection is changed periodically and reception of data is continued about the data of the receiving layer after change.

[0102] When the loss rate of a packet is smaller than a threshold and a transceiver rate ratio is larger than a threshold in the receiving terminal 1-21, 1-22…, which receives the Enhancement layer of the upper layer that a loss rate is smaller than a threshold when a transceiver rate ratio is also smaller than a threshold, the FEC layer that has received is reduced, when a loss rate is larger than a threshold and a transceiver rate ratio is larger than a threshold enough, a FEC layer is newly received and when that a loss rate is larger than

a threshold a transceiver rate ratio is smaller than a threshold, the Enhancement layer that receives is reduced sequentially from the thing of a higher rank.
[0103] Thus, in the 1st embodiment of this invention, when carrying out data communications to a plurality of receiving terminals via a network from a transmission terminal, it becomes possible to transmit data with the optimal quality and the optimal error tolerance according to the situation of an intervening different network for every receiving terminal. Thus, when you need real time nature that relays simultaneously the raw image captured with the camera to many televiewers, the outstanding effect of acting effectively especially is acquired.
[0104] [The 2nd embodiment] Drawing 10 is a block diagram showing the composition of the data communication unit according to the 2nd embodiment of this invention. Via the network 1021, as for the data communication unit according to the 2nd embodiment of this invention, the transmitting side terminal 1001 and the receiving side terminal 1002 are constituted so that communication is possible. The mentioned above transmitting side terminal 1001 is provided with the image capturing device 1010, the coder 1011, the data transmission section 1012, the FEC data generating section 1013 and the FEC data transmission section 1014. The mentioned above receiving side terminal 1002 is provided with the data reception section 1031,

the FEC data reception section 1032, the error correction section 1033, the decoding device 1034, the image display device 1035 and the received series selecting section 1036.

[0105] If the outline function of each section of the mentioned above transmitting side terminal 1001 and the receiving side terminal 1002 is explained, in the transmitting side terminal 1001, the image capturing device 1010 will capture the image of a display screen as a file. The coder 1011 generates a hierarchical data series from the inputted video signal. The data transmission section 1012 generates a data packet based on coding data, forms a fundamental series and an extension series according to the hierarchy of coding and sends them out to the network 1021. The FEC data generating section 1013 generates FEC data based on the data packet of each series. The FEC data transmission section 1014 packetizes FEC data and sends it out to the network 1021.

[0106] On the other hand, in the receiving side terminal 1002, the data reception section 1031 receives coding data via the network 1021. The FEC data reception section 1032 receives FEC data via the network 1021. The error correction section 1033 performs restoration processing of a loss packet. The decoding device 1034 decodes coding data. The image display device 1035 displays the received picture.

The received series selecting section 1036 changes a received series with a certain time interval based on the information on packet loss.

[0107] The function of the important section of the mentioned above transmitting side terminal 1001 and the receiving side terminal 1002 is explained in full details with operation. First, the function and operation of the transmitting side terminal 1001 are explained. The coder 1011 generates a hierarchical data series from the inputted video signal. Although the way one coder outputs several coding data in which resolution differs from the signal to noise ratio about a hierarchical method, the method of outputting the encoded system from which a frame rate differs using a plurality of coder, etc. can be used, it does not specify about the method here. It is sent to the data transmission section 1012, a data packet is generated here and the coded data forms a fundamental series and an extension series according to the hierarchy of coding, respectively and is sent out to the network 1021.

[0108] For example, in multicasting, one transmission series is equivalent to one multicast group. Simultaneously, a data packet is sent to the FEC data generating section 1013, FEC data is generated based on the data packet of each series and FEC data is packetized by the FEC data transmission section 1014 and is sent out to the network 1021.

Similarly in multicasting, one FEC data series is equivalent to one multicast group. In the data transmission section 1012, a series number (series number) and a time stamp (data transmission time information) are independently added to a data packet for every series, in the FEC data generating section 1013, a series number, a packet number, etc. of a data packet that were used for FEC data are added as header information.

[0109] Next, the function and operation of the receiving side terminal 1002 are explained. Only a series with the selected received series selecting section 1036 is received by the data reception section 1031. Packet loss is detected from the series number added to the packet here and it reports to the received series selecting section 1036. In the received series selecting section 1036, the reported information on packet loss is totaled and a received series is changed with a certain time interval based on it. The received data is sent to the error correction section 1033, when FEC data is received and restoration processing of a loss packet is performed. After reconstructing in the unit (for example, one frame) which can decode a data packet with the decoding device 1034, it decodes to a video signal.

[0110] Drawing 20 is an explanatory view in which the program and associated data of this invention show the conceptual example supplied to a device from a

storage. The program and associated data of this invention are supplied by inserting the storages 2001, such as a floppy disk and CD-ROM, in the loading slot 2003 of the storage drive equipped by the device 2002. Then, the program and associated data of this invention are once installed on a hard disk from the storage 2001 and it loads to RAM from a hard disk or whether in loading to RAM directly, without installing on a hard disk, it becomes possible to execute the program of this invention.

[0111] In this case, when executing the program of this invention in the data communication unit according to the 2nd embodiment of this invention, for example. whether the program and associated data of this invention are supplied to a data communication unit (the transmitting side terminal 1001, the receiving side terminal 1002) in a procedure as shown on the mentioned above drawing 20 or program execution becomes possible by storing the program and associated data of this invention in a data communication unit (the transmitting side terminal 1001, the receiving side terminal 1002) preliminary.

[0112] Drawing 19 is an explanatory view showing the example of composition of the memory content of the storage that stored the program and associated data of this invention. The storage of this invention includes a memory content of the volume information 1901, the directory information 1902, the program execution file

1903 and program related data file 1904 grade, for example. The program of this invention is program coded based on the flow chart of mentioned below drawing 16.

[0113] The correspondence relation between each constituent features in the claim of this invention and each section of the data communication unit (the transmitting side terminal 1001, the receiving side terminal 1002) according to the 2nd embodiment of this invention is as follows. An encoding means corresponds to the coder 1011 of the transmitting side terminal 1001 and the data generation means for correction corresponds to the FEC data generating section 1013 of the transmitting side terminal 1001, a transmitting means corresponds to the data transmission section 1012 of the transmitting side terminal 1001 and the FEC data transmission section 1014, a data packetized means corresponds to the data transmission section 1012 of the transmitting side terminal 1001, the data packetized means for correction corresponds to the FEC data transmission section 1014 of the transmitting side terminal 1001, a selecting means corresponds to the received series selecting section 1036 of the receiving side terminal 1002, a reception means corresponds to the data reception section 1031 of the receiving side terminal 1002 and the FEC data reception section 1032 and a state acquisition means corresponds to the function that

the received series selecting section 1036 of the receiving side terminal 1002 has. The data communication unit of the transmitting side corresponds to the transmitting side terminal 1001, the data communication unit of a receiver corresponds to the receiving side terminal 1002 and a network is equivalent to the network 1021.

[0114] Next, about the generation processing of the data for the error correction in the data communication unit according to the 2nd embodiment of this invention constituted like the above. As a coding mode, Motion JPEG (Joint Photographic Experts Group: color still picture compression technology), parity data is used as FEC data, it is RTP (Rapid Transport) to a communications protocol. Protocol : the high-speed protocol / UDP (User Datagram Protocol: one of the multimedia protocols) / IP of the transport layer (Internet Protocol: protocol of the 3rd layer network layer of open systems interconnection reference model). The case where it uses is explained referring to drawing 11 - drawing 15 for an example.

[0115] The picture image data for one frame is inputted into the coder 1011 of the transmitting side terminal 1001 and JPEG compression is performed. Although the coded data is packetized for transmission, since fragmentation arises when this packet size is larger than the minimum MTU (Max Transfer Unit: a maximum transmission unit and

Ethernet 1500 bytes) of a channel, coding data is divided preliminary and a plurality of packets are generated so that the packet size generated may not exceed MTU. At this time, division is performed from the head of coding data so that the packet size after dividing in order to make small the overhead by the header added in the case of transmission as much as possible may become equal to MTU. 8 bytes of RTP JPEG pay-load header (drawing 11) and 12 bytes of RTP header (drawing 12) are added to the divided data and one RTP packet is constituted (pay load: information transmitted in a cell).

[0116] Although one or more FEC data is generated by performing bit operations, such as XOR (exclusive OR), to the packet of these plurality, when calculating to the whole RTP packet currently divided per MTU as mentioned above at that time, by adding a RTP FEC pay-load header and an RTP header to the generated FEC data, a FEC packet exceeds MTU size and fragmentation occurs (drawing 13). In order to avoid this, the FEC data of the same size as source data is generated only using the JPEG data section of the data packets (drawing 14). Thus, the header size that can be added to this FEC data is the same 20 bytes as it of source data, that is, should just design 8 bytes of the same FEC pay-load header as a JPEG pay-load header. The method is explained below.

[0117] First, the header information needed for reconstructing the original coding data from the data divided into a plurality of packets by the addressee side,
RTP header: data length, a marker bit, time stamp
RTP JPEG pay-load header: image size, Q value and offset
It is 6 and it is necessary to also restore these information in the case of restoration of a lost packet. Information required when restoring a lost packet using FEC is the series number and packet number for identifying the packet used for FEC data generation. It is necessary to restore these 8 header information.
[0118] First, in these information, within image size, Q value (parameter that directs the compression ratio (ratio of the data volume of the still picture and the still picture after compression) of a picture) and the frame same about a time stamp, it is fixed and since it is available, the value of a packet before and after receiving is not included in a header. Next, about offset, since it can restore using these, when the data length and the marker bit of the packet of order are obtained, it does not include in a header. Thus, the information that needs to be included in a header serves as data length, a marker bit, a series number of source data and a packet number. Since the section of all the packets used for FEC data generation is required for data length and a marker bit, they include in a

header what took such XOR here. The composition of a FEC pay-load header is shown on drawing 15. The technique of this FEC packet generation is applicable in the 1st embodiment too.

[0119] Next, the case where hierarchically encoding is performed selection method of the received series in the receiver in the data communication unit according to the 2nd embodiment of this invention about the frame rate is explained concretely, referring to drawing 16 for an example.

[0120] First, when starting reception of an image, an addressee receives only a fundamental series (Step S1601). It is equivalent to the intervention to the multicast group by which the fundamental series is transmitted in the case of multicasting and transmission of the join message of IGMP is used for this. After starting reception of a fundamental series, the receiving side terminal 1002 (addressee) measures a packet loss rate for every fixed time (Step S1602). When a packet loss rate is less than a predetermined threshold, at the (step S1603 NO), since reception with the reception rate which the state of a channel is good and requires mostly can be performed, by receiving more data, it considers raising an effective reception rate and one of the extension series is newly received (Step S1607 - Step S1609). When it judges that it judged whether the FEC series would be received now and has received at Step S1607, one received FEC

series is reduced (Step S1608), one of the extension series is newly received (Step S1609) and when it, on the other hand, judges that it has not received at Step S1607, one of the extension series is newly received (Step S1609).

[0121] At this time, when it displays after annexing these by the receiver and performing timing suitably by hierarchically encoding at the transmitting side so that the frame data of a fundamental series may be interpolated with the frame data of an extension series, an effective frame rate can be raised. The time stamp added to the packet can be used for the determination of the order of a frame in annexation.

[0122] On the other hand, when the mentioned above packet loss rate which measured exceeds a threshold and the reception rate to demand are not achieved at the (step S1603, YES), but the effect by receiving an extension series and raising the reception rate of data becomes weaker. Next, (Step S1604 - Step S1606) and error tolerance can be improved by newly receiving one series of FEC data and an effective reception rate can be raised by restoring a packet loss rate. When it judges that it judged whether the extension series would be received now and has received at Step S1604, one received extension series is reduced (Step S1605), one of the FEC series is newly received (Step S1606) and when it, on the other hand, judges that it

has not received at Step S1604, one of the FEC series is newly received (Step S1609).
[0123] Thus, the addressee can attain suitable receiving quality by changing raising a receiving data rate bordering on a certain threshold and improving error tolerance and receiving.
[0124] Next, it explains, referring to drawing 17 for the deciding method of the threshold of the mentioned above packet loss rate in the data communication unit according to the 2nd embodiment of this invention.
[0125] As a factor that determines this threshold, MTU of a coding mode and a compression ratio, frame size and a channel, the relative redundancy of FEC, etc. are mentioned. Here, at the transmitting side, the threshold which corresponds with reference to the table for every coding mode as shows drawing 17 shall be chosen from the parameter which notified parameters, such as frame size, a compression ratio, relative redundancy of FEC, to the receiver and was notified in the addressee side as the deciding method. Such a table shall be created based on an actual measurement, a simulation, etc. in an actual network and shall be preliminary prepared for the addressee.
[0126] Next, it explains, referring to drawing 18 for the example of the grouping of the transmission series in the data communication unit according to the 2nd embodiment of this invention.

[0127] In a situation that differ in the range whose bandwidth of the channel which a fundamental series is not restricted to one and multicasting becomes large-scale and to which the addressee is connected when carrying out this invention is several drawings, it is shown on drawing 18 as ISDN (Integrated Service Digital Network: Comprehensive Digital Network) , such as 64k bps, 384k bps and 10Mbps for LAN, a plurality of groups for every circuit are formed and a send data series and an error correction data series are hierarchically encoded in each group. And this invention is carried out also by each addressee's performing intervention to the group who was suitable for each communication environment preliminary and choosing the series in a group appropriately after that and receiving.

[0128] As explained above, according to the data communication unit according to the 2nd embodiment of this invention, the transmitting side terminal 1001, the coder 1011 that codes data hierarchical, the FEC data generating section 1013 which generates FEC data to each data coded hierarchical, the data coded hierarchical and FEC data are made into a respectively different data series. Including the data transmission section 1012 which transmits and the FEC data transmission section 1014 and the receiving side terminal 1002, since it has the received series selecting section 1036 which chooses a suitable data series

based on a receiving state out of a respectively different data series, the data reception section 1031 which receives the selected data series and the FEC data reception section 1032, following operations and effects are done so.

[0129] In the mentioned above composition, for every unit which transmits data into a data series, the data transmission section 1012 of the transmitting side terminal 1001 adds data transmission time information (time stamp) and the series number (series number) and transmits. In this case, the data series which transmit by the data transmission section 1012 are a fundamental series according to the hierarchy of coding of data, one or more extension series that are the upper layer of this fundamental series and a FEC data series according to the FEC data generated to the data coded hierarchical.

[0130] In the receiving side terminal 1002, the rate of a data loss (packet loss rate) is acquired as a receiving state. The received series selecting section 1036 of the receiving terminal 1002, when the rate of a data loss is receiving a FEC data series smaller than a predetermined threshold, when the received FEC data series is reduced, an extension series is received further and the rate of a data loss has not received the FEC data series smaller than a predetermined threshold, when the extension series received when the extension series of a higher rank is received and the rate of a data

loss is receiving an extension series more greatly than a predetermined threshold is reduced, a FEC data series is received further and the rate of a data loss has not received the extension series more greatly than a predetermined threshold, a FEC data series is received further.

[0131] In the 2nd embodiment of this invention by this, when performing data communications simultaneously with many addressees via a network, each addressee the communication environment and by carrying out, as which a reception rate and the grant rate of FEC data are sometimes chosen accommodative according to the receiving condition, that is, the outstanding effect that good communication quality is realizable is acquired by choosing the reception rate and error tolerance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in multicasting environment.

[0132] [Other embodiments] In the 1st - the 2nd embodiment of this invention mentioned above, although not specified about a network kind, when this invention is applied to large-scale networks, such as the Internet, its effect is large. Also, this invention is applicable to the data communications through various kinds of networks, such as LAN other than the Internet.

[0133] In the 1st embodiment of this invention mentioned above, although the camera server was raised to the example and explained as a transmitting side terminal, this invention is not limited by this, either. For example, also when reproducing the dynamic image file stored by the external storage and giving one's service to a client, it can apply.
[0134] In the 2nd embodiment of this invention mentioned above, as the transmitting side terminal and the receiving side terminal were shown on the mentioned above drawing 10, raised the case where every one set each connected with a network to the example. This invention is not limited to the composition of the mentioned above drawing 10 and also when making a plurality of set number connection arbitrary to a network, it can apply a transmitting side terminal and a receiving side terminal.
[0135] This invention is not what is limited only to the device and method for realizing the mentioned above embodiment, to the computer (CPU or MPU) in the mentioned above system or a device. The program code of the software for realizing the mentioned above embodiment is supplied and also when the computer of the mentioned above system or a device operates the various the mentioned above devices according to this program code and it realizes the mentioned above embodiment, it is contained under the category of this invention.

[0136] The program code of the mentioned above software itself will realize the function of the mentioned above embodiment in this case, the means for supplying the program code itself and its program code to a computer and the storage that specifically stored the mentioned above program code are contained under the category of this invention.
[0137] As a storage that stores such a program code, a floppy disk, a hard disk, an optical disc, a magneto-optical disc, CD-ROM, magnetic tape, a nonvolatile memory card, ROM, etc. can be used, for example.
[0138] When the mentioned above computer controls various devices only according to the supplied program code, OS in which not only when the function of the mentioned above embodiment is realized, but the mentioned above program code is working on a computer (operating system) or also when the mentioned above embodiment is realized in collaboration with other applications, this program code is contained under the category of this invention.
[0139] After this supplied program code was stored in the memory with which the function expansion unit connected to the expansion board of a computer or the computer is equipped, based on directions of the program code, a section or all of processing that CPU etc. with which the expansion board and function expansion unit are equipped are actual is performed and also when the mentioned above embodiment is

realized by the processing, it is contained under the category of this invention.

[0140]

[Effect of the invention] As explained above, according to the data communication system according to claims 1 - 13, when performing data communications simultaneously with many addressees via a network, the outstanding effect that good communication quality is realizable is acquired by choosing the reception rate and error tolerance to which each addressee was suitable for each receiving environment. It is effective when distributing real time animation media especially in multicasting environment.

[0141] By what the data communication unit of the transmitting side and the data communication unit of a receiver constitute a data communication system for according to the data communication unit according to claims 14 - 20 and the data communication unit according to claims 21 - 30. The outstanding effect that good communication quality is realizable is acquired like the above. It is effective when distributing real time animation media especially in multicasting environment.

[0142] According to the data communication method according to claims 31 - 43, the outstanding effect that good communication quality is realizable is acquired like the above by applying a data communication

method to a data communication system (a data communication unit of the transmitting side and a data communication unit of a receiver). It is effective when distributing real time animation media especially in multicasting environment.

[0143] By what according to the storage according to claims 44 - 56 a data transmission method is read from a storage and performed by a data communication system (a data communication unit of the transmitting side and a data communication unit of a receiver). The outstanding effect that good communication quality is realizable is acquired like the above. It is effective when distributing real time animation media especially in multicasting environment.

[Brief description of the drawings]

[Drawing 1] is a block diagram showing the example of composition of the data communication unit according to the 1st embodiment of this invention.

[Drawing 2] is a flow chart which shows the data transmission processing by the side of the transmission terminal of the data communication unit according to the 1st embodiment of this invention.

[Drawing 3] is a flow chart which shows the data receiving processing by the side of the receiving terminal of the data communication unit according to the 1st embodiment of this invention.

[Drawing 4] is a flow chart which shows the receiving layer selection process in the receiving terminal of the data communication unit according to the 1st embodiment of this invention.
[Drawing 5] is an explanatory view showing the transmitting and receiving condition of the hierarchically encoded data according to the 1st embodiment of this invention.
[Drawing 6] is a block diagram showing the example which applied the data communication unit according to the 1st embodiment of this invention to the data communication system.
[Drawing 7] is a flow chart which shows the data transmission processing in the camera server of the data communication system according to the 1st embodiment of this invention.
[Drawing 8] is a flow chart which shows the data receiving processing in the client of the data communication system according to the 1st embodiment of this invention.
[Drawing 9] is a flow chart which shows the receiving layer change processing in the client according to the 1st embodiment of this invention.
[Drawing 10] is a block diagram showing the example of composition of the data communication unit according to the 2nd embodiment of this invention.

[Drawing 11] is an explanatory view showing the composition of the RTPJPEG pay-load header according to the 2nd embodiment of this invention.
[Drawing 12] is an explanatory view showing the composition of the RTP header according to the 2nd embodiment of this invention.
[Drawing 13] is an explanatory view showing the case where fragmentation occurs at the time of the FEC data generation according to the 2nd embodiment of this invention.
[Drawing 14] is an explanatory view showing the FEC data generation method according to the 2nd embodiment of this invention.
[Drawing 15] is an explanatory view showing the composition of the FEC pay-load header according to the 2nd embodiment of this invention.
[Drawing 16] is a flow chart which shows the processing that chooses the received series according to the 2nd embodiment of this invention.
[Drawing 17] is an explanatory view showing the table for performing threshold selection according to the 2nd embodiment of this invention.
[Drawing 18] is an explanatory view showing the example of the grouping of the transmission series according to the 2nd embodiment of this invention.
[Drawing 19] is an explanatory view showing the example of composition of the memory content of the

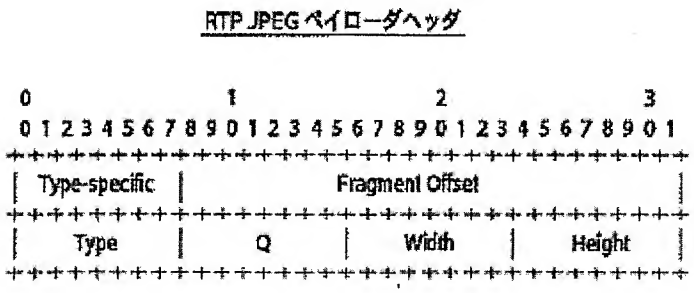
storage that stored the program and associated data of this invention.
[Drawing 20] is an explanatory view showing the conceptual example supplied to a device from storage, the program and associated data of this invention.

[Description of numerals]

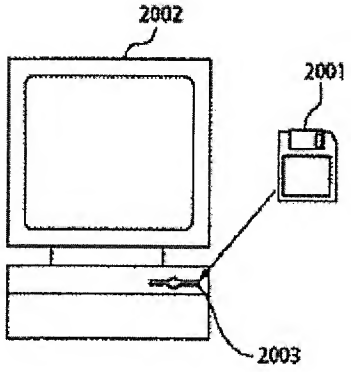
1-1 Transmission terminal
1-21, 1-22 Receiving terminal
1-3, 300 Network
1-11 Data generating section
1-121 Layer 1 transmission section
1-122 Layer 2 transmission section
1-123 Layer 3 transmission section
1-124 Layer 4 transmission section
1-125 Layer 5 transmission section
1-211 Data reception section
1-212 Data processing section
1-213 Receiving layer selecting section
1-124 Receiving condition monitor section
10 Camera server
20 Client
100 Camera 103, 203 CPU
109, 209 Communication interface
208 Display
1001 Transmitting side terminal
1002 Receiving side terminal
1010 Image capturing device

1011 Coder
1012 Data transmission section
1013 FEC data generating section
1014 FEC data transmission section
1031 Data reception section
1032 FEC data reception section
1033 Error correction section
1034 Decoding device
1035 Image display device
1036 Received series selecting section
1903 Program execution file
1904 Program related data file
2001 Storage

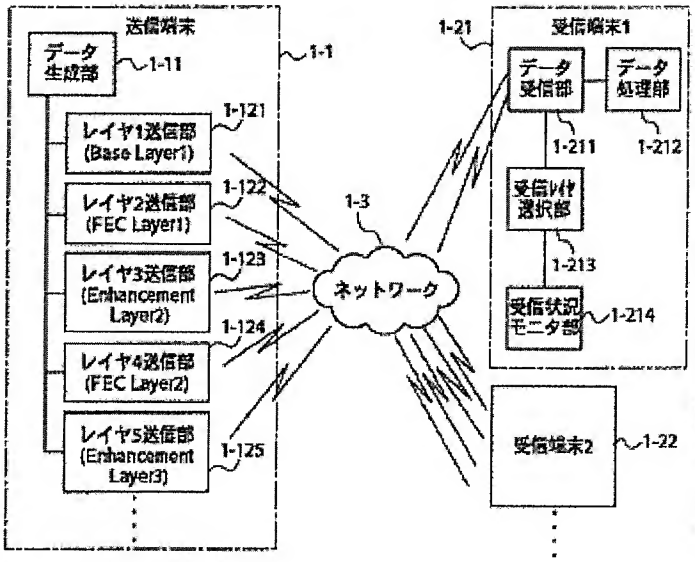
Drawing 11



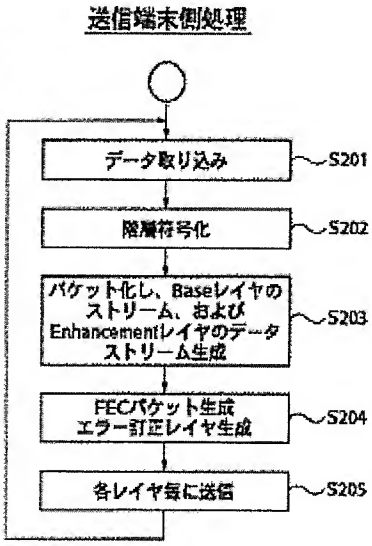
Drawing 20



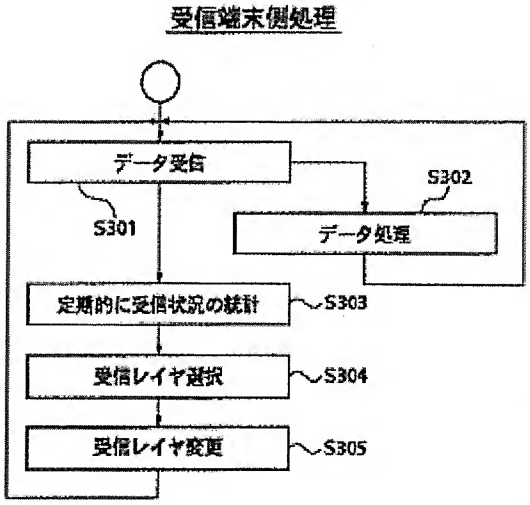
Drawing 1



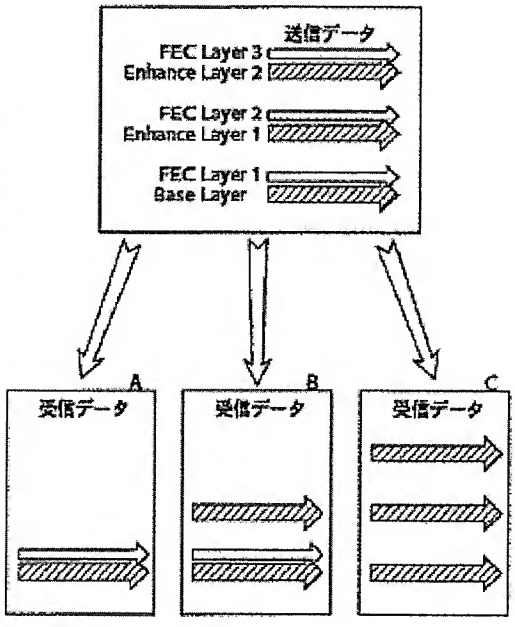
Drawing 2



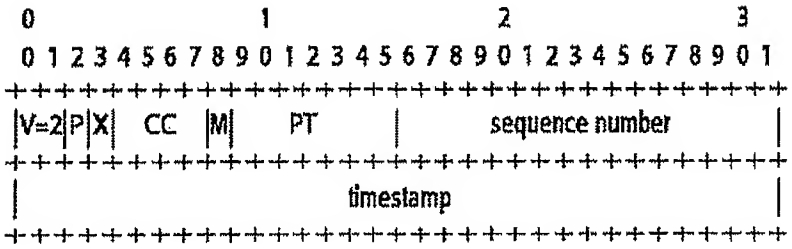
Drawing 3



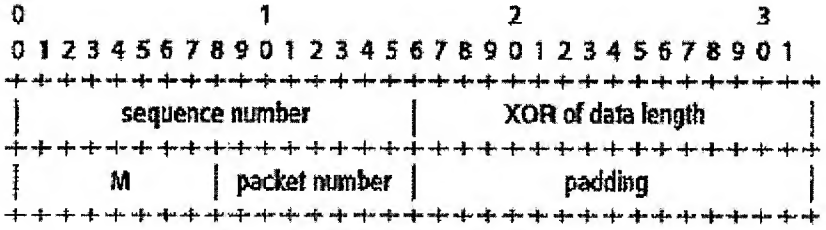
Drawing 5



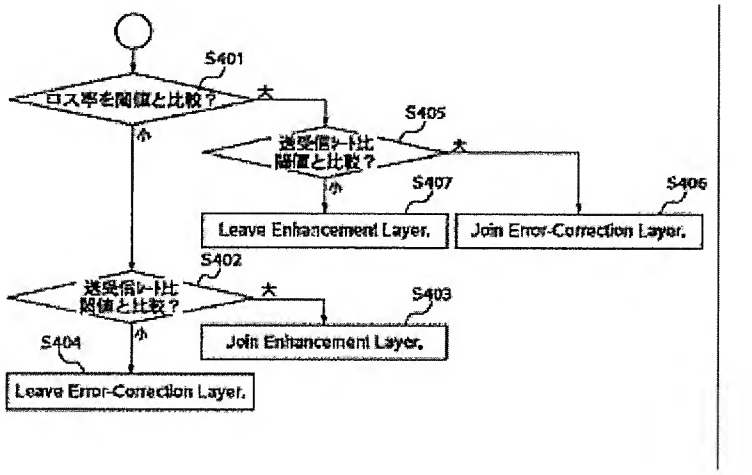
Drawing 12



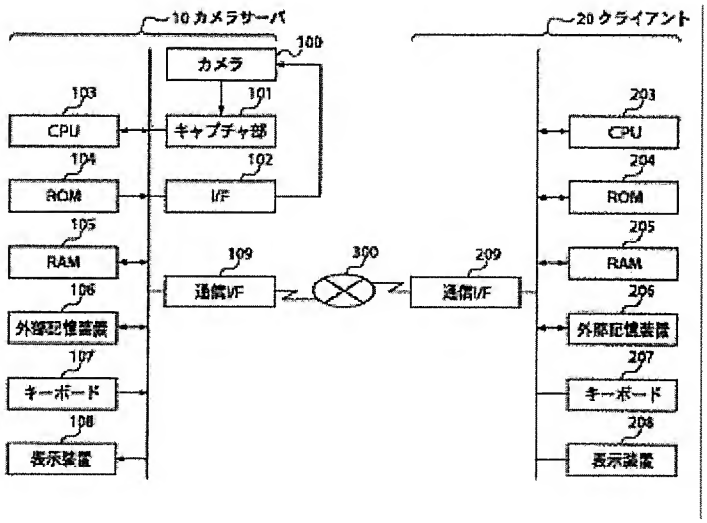
Drawing 15



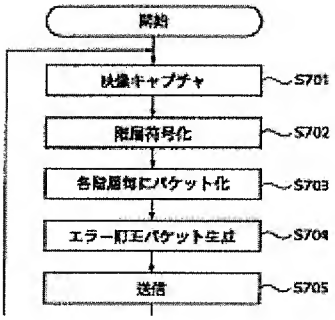
Drawing 4



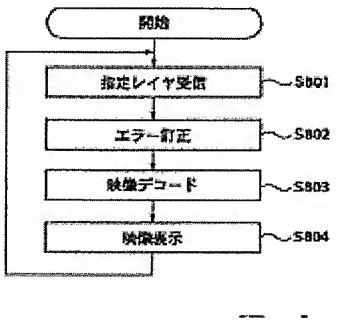
Drawing 6



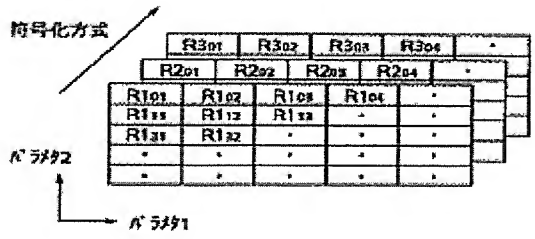
Drawing 7



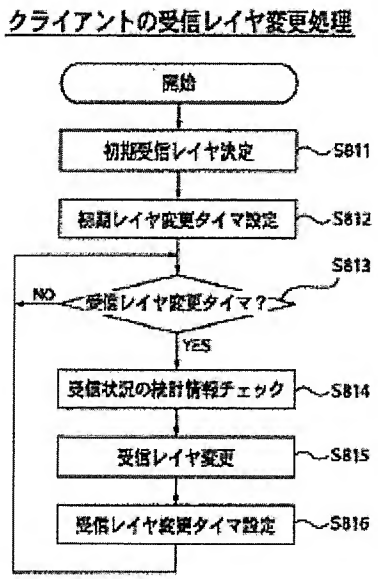
Drawing 8



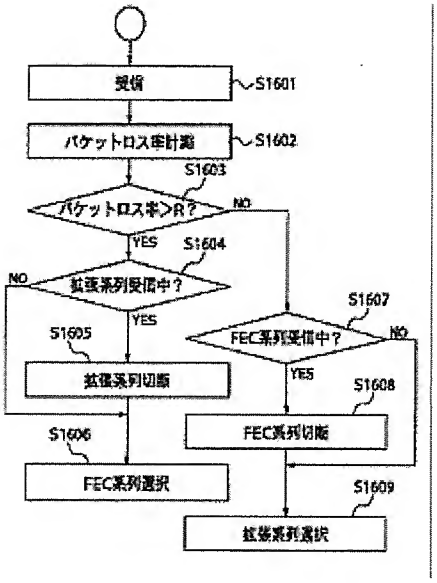
Drawing 17



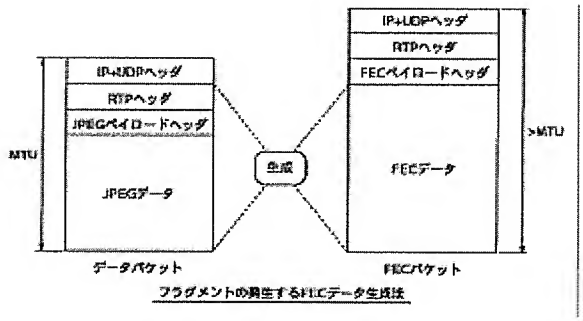
Drawing 9



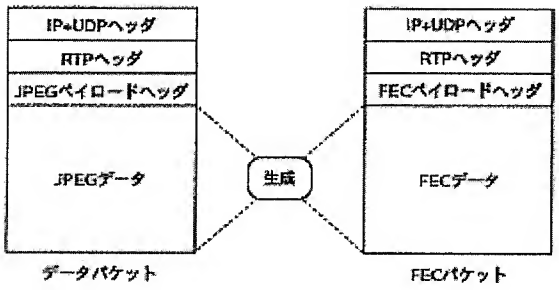
Drawing 16



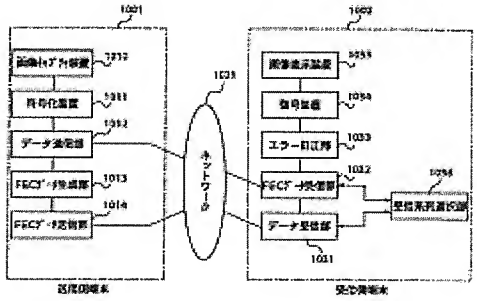
Drawing 13



Drawing 14



Drawing 10



Drawing 18

Drawing 19